1. There is a gene for sleepwalking. A father who is **always sleepwalking** has children with a mother who is **sometimes sleepwalking and other times she doesn't sleepwalk**. After many years they have many children expressing the percentages of the phenotypes shown below.

25% females that **sometimes sleepwalk and other times never do**	25% females that are **always sleepwalking**	25% males that are **never sleepwalking**	25% males that are **always sleepwalking**
X^SX^N	X^SX^S	X^NY	X^SY

a. **Construct** a Punnett square that shows what the genotypes of the parents & children are.
b. **Identify** & **explain** the type(s) of inheritance pattern(s) shown

- Males ≠ Females affected differently = X-linked
- Mom shows both phenotypes = codominance

	X^S	X^N
X^S	X^SX^S	X^SX^N
Y	X^SY	X^NY

2. A dihybrid (P_fS_s) purple bodied, spiny snake x double recessive ($ffss$) white body, smooth snake (testcross) produced the offspring in the table below.

a. Calculate the distance between these 2 genes → # recombinants ÷ total offspring = $\frac{62+53}{1544} = 7.4$ map units
b. Calculate the Chi square value for the hypothesis that these two genes assort independently.

731 Purple, Spiny	698 White, Smooth	62 Purple, Smooth	53 White, Spiny

observed # offspring

$P_fS_s \times ffss$

P_fS_s → PS, P_s, fS, fs

$ffss$ → fs, fs, fs, fs

	PS	P_s	fS	fs
fs	P_fS_s	P_fss	ffS_s	$ffss$
	25%	25%	25%	25%

Expected percentages

Total offspring = 1544

	$(O-e)^2/e$	Expected # offspring
Purple Spiny	308	386
White Smooth	252	386
Purple Smooth	272	386
White Spiny	287	386

$\sum = 1,119 = \chi^2 >$ C.V. = Reject N.H... genes DON'T assort independently, they are linked

3. Two genes are linked and located 31 m.u. apart. If there were 1104 parental type offspring from a dihybrid x double recessive (testcross), what was the total number of offspring from the testcross?

$.31 = \frac{r}{1104 + r}$ → $342 + .31r = r$

$342 = 0.69r$

$496 = r$

total offspring = 496 + 1104

= 1600 total offspring

4. 4 Genes, ABCD, control 4 different traits in an organism & are unlinked genes. For the cross below, what is the probability that the offspring will be heterozygous for all 4 traits?

AaBbccDD x AabbCcdd

Aa: AA, Aa, Aa, aa → 2/4

Bb: Bb, bb, Bb, bb → 2/4

cc: Cc, Cc, cc, cc → 2/4

DD: Dd, Dd, Dd, Dd → 1

2/4 AND × 2/4 AND × 2/4 AND × 1 = 1/8

5. 1 couple consisting of a homozygous dominant individual & a heterozygous individual have children. A second couple, both heterozygous, also has children. Assume that a child from couple 1 and a child from couple 2 eventually have children together. What is the probability of their child being homozygous recessive?

(P)

Couple 1: AA × aa → Aa, Aa, Aa, Aa — can't produce an "aa" child

Couple 2: Aa × Aa → AA, Aa, Aa, aa

F_1: couple 1 child (A, a) × couple 2 child (a, a) → Aa, Aa, aa, aa

couple 1 child (A, a) × couple 2 child (A, a) → AA, Aa, Aa, aa ← only these 2 crosses can produce "aa"

F_1 probabilities:

– prob of aa?

3/8 from below × 3/8 of "aa" in F_1 cross

3/8 × 3/8 = 9/64 Final Answer

F_2 aa?

couple 1 – prob of Aa child? = 1/2 → probability of this 1/2

AND ×

couple 2 – prob of Aa child? = 1/2 –OR→ + prob of aa child? = 1/4 → Probability of this 3/4

= 3/8

6. A woman (heterozygous for brown eyes & a carrier for hemophilia) and a man (with green eyes & hemophilia) have children. Assuming that hemophilia is X-linked recessive & green eye color is autosomal recessive, what is the probability of them having a green-eyed female child with hemophilia?

$Bb X^hX \times bb X^hY$

	Bb	bb
b	Bb	bb
b	Bb	bb

½ probability of green eyes

	X^h	X
h	X^hX^h	X^hX
Y	X^hY	XY

¼ probability of female with hemophilia

½ (green eyes) × ¼ (female hemophilia) = 1/8 of a green-eyed hemophilia female child.

7. Hair color in humans is controlled by 2 genes: B for tone of color & M for amount of color. BBMM, BbMM or BBMm is black; bbMM or bbMm is light brown; BBmm or Bbmm is dark brown; bbmm is blonde. Write the possible & impossible phenotypes for each cross.

a. light brown x light brown

bbM_ × bbM_

bbMm or BbMM for all offspring = Light Brown

All other colors impossible

b. blonde x black

bbmm × B_M_

BbMm = Black
bbmm = blonde
Bbmm = dark brown
bbMm = light brown

All possible offspring

c. light brown x blonde

bbM_ × bbmm

bbMm = light brown
bbmm = blond

All other colors impossible

d. Dark brown x blonde

B_mm × bbmm

Bbmm = dark brown
bbmm = blonde

All other colors impossible